

REMARKS

Upon entry of the instant amendment, claims 1, 3-5, 7, 9-11 and 13-20 will remain pending in the present application.

In the instant amendment, claims 2, 6, 8 and 12 have been canceled without prejudice or disclaimer of the subject matter contained therein. Claims 1, 3-5, 7 and 9-11 have been amended. Also, new claims 13-20 have been added.

The instant amendment made herein to the claims does not incorporate new matter into the application as originally filed. For example, claims 1, 4, 7 and 10 have been amended by incorporating features of claims 2, 6, 8 and 12, respectively. New claims 13-16 are based on the disclosure at page 10, lines 12-14 of the instant specification, respectively. New claims 17-20 are based on the disclosure at page 10, line 20 of the instant specification, respectively.

Accordingly, proper consideration of each of the pending claims is respectfully requested at present, as is entry of the present amendment.

Information Disclosure Statements

The Crossed-Out-References

Applicants appreciate the Examiner returning the initialed PTO-1449 forms submitted by Applicants on June 25, 2007, November 13, 2006 and March 22, 2007.

Regarding the crossed-out-references (i.e., JP 6-140218, JP 6-108190, JP 2001-167917, JP 5-226125, JP 2000-232011, and JP 2002-184615), Applicants would file a IDS therefor.

Thus, the Examiner is respectfully requested to consider these references and return an initialed copy of the PTO-1449 form to the undersigned.

IDS Filed on July 19, 2007

Further, please note that Applicants filed another IDS on July 19, 2007. Thus, the Examiner is respectfully requested to consider the references listed thereon and return an initialed copy of the PTO-1449 form to the undersigned.

Rejections of Claims 4-12 under 35 USC § 103

At paragraphs "4." to "6." at pages 3-5 of the Office Action, claims 4-6 have been rejected under 35 USC § 103(a) as being unpatentable over JP '009 (JP 2002-118009); and claims 7-12 have been rejected under 35 USC § 103(a) as being unpatentable over Nishiuchi US '196 (US 6,251,196) or Nishiuchi US '590 (US Publication 2001/0030590). Further, at paragraph "10." at page 7 of the Office Action, claims 4-6 have been rejected under 35 USC § 103(a) as being unpatentable over Sakaki US '541 (US 6,623,541). Please note that Sakaki US '541 is a counterpart of JP '009.

Applicants respectfully traverse and request that the Examiner withdraw each of these rejections based upon the following considerations.

Non-Obviousness of Claims 4-6 over JP '009 and Nishiuchi US '196

The present invention is directed to a method of manufacturing rare-earth sintered magnets having a metal-plating step (e.g., claims 1 and 7) and a rare-earth sintered magnet having a metal-plating layer (e.g., claims 4 and 10).

However, JP '009 and Sakaki US '541 fail to disclose or suggest features of the present invention such as a metal-plating step and a metal-plating layer. The present invention and the cited references of JP '009 Sakaki and Sakaki US '541 are explained hereinbelow, referring to Sakaki US '541 since Sakaki US '541 is a counterpart of JP '009.

Sakaki US '541 merely discloses, at the claims of columns 12-13, as follows.

"1. A sintered rare earth magnet consisting essentially of 20 to 30% by weight of R wherein R is samarium or at least two rare earth elements containing at least 50% by weight of samarium, 10 to 45% by weight of iron, 1 to 10% by weight of copper, 0.5 to 5% by weight of zirconium, and the balance of cobalt and incidental impurities, said sintered rare earth magnet having on its surface a composite layer containing Sm_2O_3 or CoFe_2O_4 or both in Co or Co and Fe."

"3. A sintered rare earth magnet consisting essentially of 20 to 30% by weight of R wherein R is samarium or at least two rare earth elements containing at least 50% by weight of samarium, 10 to 45% by weight of iron, 1 to 10% by weight of copper, 0.5 to 5% by weight of zirconium, and the balance of cobalt and incidental impurities, said sintered rare earth magnet having on its surface a composite layer containing Sm_2O_3 or CoFe_2O_4 or both in Co or Co and Fe, said sintered rare earth magnet further comprising a resin coating on said composite layer."

"6. A method for preparing a sintered rare earth magnet, comprising the steps of: casting an alloy consisting essentially of 20 to 30% by weight of R wherein R is samarium or at least two rare earth elements containing at least 50% by weight of samarium, 10 to 45% by weight of iron, 1 to 10% by weight of copper, 0.5 to 5% by weight of zirconium, and the balance of cobalt and incidental impurities, grinding the alloy, followed by comminution, compacting in a magnetic field, sintering and aging to form a sintered magnet, cutting and/or polishing the sintered magnet for surface finishing, and heat treating in an atmosphere having an oxygen partial pressure of 10^{-6} to 152 torr for about 10 minutes to 20 hours so as to form on the surface of the rare earth magnet a composite layer containing Sm_2O_3 or CoFe_2O_4 or both in Co or Co and Fe."

"7. A method for preparing a sintered rare earth magnet, comprising the steps of: casting an alloy consisting essentially of 20 to 30% by weight of R wherein R is samarium or at least two rare earth elements containing at least 50% by weight of

samarium, 10 to 45 by weight of iron, 1 to 10% by weight of copper, 0.5 to 5% by weight of zirconium, and the balance of cobalt and incidental impurities, grinding the alloy, followed by comminution, compacting in a magnetic field, sintering and aging to form a sintered magnet, cutting and/or polishing the sintered magnet for surface finishing, and heating in an atmosphere having an oxygen partial pressure of 10^{-6} to 152 torr for about 10 minutes to 20 hours, said method further comprising the step of applying a resin coating on the surface of the sintered magnet after the heat treatment."

Neither a metal-plating step nor a metal-plating layer is found in these descriptions. Namely, Sakaki US '541 (and JP '009) fails to disclose or suggest the features of the present invention such as the metal-plating step or the metal-plating layer.

As disclosed in the present specification (see, for example, page 3 of the instant specification), because the $\text{Sm}_2\text{Co}_{17}$ -based magnet and the microdispersed Sm_2O_3 -containing layer of cobalt and/or cobalt and iron, which corresponds to JP '009 and Sakaki US '541, are hard and fragile, they tend to chip easily when such products are handled (e.g., during product assembly). Even though damage such as chipping has substantially no effect on the magnetic properties of rare-earth sintered magnets, it has a large effect on the resistance of the magnet to hydrogen embrittlement. Chipping reduces the hydrogen embrittlement resistance to the same level as that of a magnet having no surface layer. For example, under the condition of hydrogen atmosphere at pressure higher than 1 MPa, hydrogen embrittlement occurs, leading to breaking, cracking or degradation of the magnet material. Thus, such a product having a chip is not substantially useful under such condition.

According to the present invention, the above problem can be overcome by the employment of the metal-plating layer. Namely, the inventive magnet has an improved strength and hydrogen resistance.

However, JP '009 and Sakaki US '541 fail to disclose or suggest the features and the advantageous properties of the present invention.

Accordingly, a person having ordinary skill in the art would not be motivated by any of the teachings of the cited references and by any general knowledge to arrive at the present invention. Thus, the present invention is not obvious over JP '009 and Sakaki US '541.

Based on the foregoing explanation, Applicants respectfully request that the Examiner withdraw this rejection.

Non-Obviousness of Claims 7-12 over Nishiuchi US '196 and Nishiuchi US '590

Nishiuchi US '196 merely discloses a process for producing a permanent magnet having a film of a first metal provided on a surface thereof, and a film of oxide of a second metal provided on the film of the first metal, comprising the steps of: placing into a treating vessel an Fe-B-R based permanent magnet, wherein R is a rare earth metal, and pieces of the first metal; vibrating and/or agitating the magnet and the pieces of the first metal in the treating vessel, thereby forming on the surface of the magnet a film of a fine powder of the first metal produced from said pieces of the first metal; applying to the surface of the film of the fine powder of the first metal a sol solution produced by hydrolysis of a compound of the second metal, wherein said compound is a starting material for a film of oxide of the second metal; and subjecting the applied sol solution to a heat treatment whereby a film of oxide of the second metal is formed on the film of the first metal.

Regarding Nishiuchi US '590, the cited reference discloses an Fe-B-R based permanent magnet having a metal oxide film having a thickness of 0.01 μm to 1 μm on the surface thereof

with a metal film interposed therebetween. Further, Nishiuchi US '590 discloses a process for producing an Fe-B-R based permanent magnet, comprising the steps forming a metal film on the surface of an Fe-B-R based permanent magnet by a vapor deposition process, applying a sol solution produced by the hydrolytic reaction and the polymerizing reaction of a metal compound which is a starting material for a metal oxide film, to the surface of said metal film, and subjecting the applied sol solution to a heat treatment to form a metal oxide film having a thickness in a range of 0.01 μm to 1 μm .

However, Nishiuchi US '590 and Nishiuchi US '196 also fail to disclose or suggest the metal-plating step, especially an electroplating step and an electroplating layer (see claims 17-20).

Therefore, the cited references fail to disclose or suggest such features of the present invention.

Further, according to the present invention (e.g., a method of manufacturing rare-earth sintered magnets), hydrogen embrittlement can be avoid even in a high-pressure hydrogen atmosphere. The method of the present invention involves steps such as surface machining a sintered and aged magnet, then metal-plating the surface-machined magnet and subjecting it to optimal heat treatment so as to form on the surface of the magnet a layer of excellent hydrogen resistance.

However, Nishiuchi US '590 and Nishiuchi US '196 merely discloses the corrosion resistance of the magnet, but do not give any consideration to the resistance to hydrogen. Thus, the cited references fail to disclose or teach hydrogen resistance.

Accordingly, a person having ordinary skill in the art would not be motivated by any of the teachings of the cited references and by any general knowledge to arrive at the present invention. Thus, the present invention is not obvious over Nishiuchi US '590 and Nishiuchi US '196.

Based on the foregoing explanation, Applicants respectfully request that the Examiner withdraw this rejection.

Nonstatutory Obviousness-Type Double Patenting

Claims 4 to 6 have been rejected on the grounds of nonstatutory obviousness-type of double patenting over claims 1-24 of Sakaki US '541.

Upon entry of the instant amendment to the claims, claims 4-5 have been further distinguished from claims 1-24 of Sakaki US '541. (Claim 6 has been canceled.)

Accordingly, Applicants respectfully request the Examiner withdraw this rejection.

Allowable Subject Matter (Claims 1 and 3)

Claims 1 and 3 are not rejected based on the specific reasons in the Office Action. Thus, the Examiner is respectfully requested to clearly indicate at least claims 1 and 3 are allowable.

CONCLUSION

Based upon the amendments and remarks presented herein, the Examiner is respectfully requested to issue a Notice of Allowance clearly indicating that each of the pending claims are allowed under the provisions.

Should there be any outstanding matters that need to be resolved in the present application, the Examiner is respectfully requested to contact Gerald M. Murphy (Reg. No. 28,977) at the telephone number below, to conduct an interview in an effort to expedite prosecution in connection with the present application.

If necessary, the Commissioner is hereby authorized in this, concurrent, and future replies, to charge payment or credit any overpayment to Deposit Account No. 02-2448 for any additional fees required under 37 C.F.R. §§ 1.16 or 1.17; particularly, extension of time fees.

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Respectfully submitted,

By 

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